GPT-GNN: Generative Pre-Training of Graph Neural Networks

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Abstract

Graph neural networks (GNNs) have been demonstrated to be powerful in modeling graph-structured data. However, training GNNs requires abundant task-specific labeled data, which is often arduously expensive to obtain. One effective way to reduce the labeling effort is to pre-train an expressive GNN model on unlabelled data with self-supervision and then transfer the learned model to downstream tasks with only a few labels. In this paper, we present the GPT-GNN framework to initialize GNNs by generative pre-training. GPT-GNN introduces a self-supervised attributed graph generation task to pre-train a GNN so that it can capture the structural and semantic properties of the graph. We factorize the likelihood of graph generation into two components: 1) attribute generation and 2) edge generation. By modeling both components, GPT-GNN captures the inherent dependency between node attributes and graph structure during the generative process. Comprehensive experiments on the billion-scale open academic graph and Amazon recommendation data demonstrate that GPT-GNN significantly outperforms state-of-the-art GNN models without pre-training by up to 9.1% across various downstream tasks?